

**POWER SUPPLY EVENT NOTIFICATION
SYSTEM**

Field of the Invention

5 The present application relates generally to an event notification system for a power supply. More specifically, it relates to event monitoring and notification for an uninterruptible power supply (UPS).

Background of the Invention

10 The use of UPS's having battery back-up systems to provide regulated, uninterrupted power for critical and/or sensitive loads, such as computer systems and other data processing systems is well known. In one application, one to several UPS's can be connected to a computer network so that the network can communicate with each UPS.

15 In some instances, it may be necessary to know if a certain event, such as a battery failure, has happened to a UPS. A prior method of detecting an event in a UPS included manually searching through trap logs to look for an indication that a certain event happened to a UPS. However, this method can be ineffective and time consuming if hundreds or thousands of UPS's are connected to a computer network.

20 One prior art software package, Powerchute Plus, manufactured by the American Power Conversion Corp. of W. Kingston, RI, is installed on a single computer or server and monitors the UPS connected to that computer for certain types of data. However, when Powerchute Plus is installed on a computer, it only monitors the UPS that is

connected to that computer. Thus, under normal operating conditions, a single copy of the Powerchute Plus software will not monitor a plurality of UPS's connected to a network.

Summary of the Invention

5 In one embodiment of the invention, the event notification system for a plurality of power supplies coupled to a computer network includes a computer system connected to the computer network, wherein the computer system includes a database, a data retrieval program, a comparison program and an electronic notification program. The data retrieval program obtains data from the plurality of power supplies. The comparison
10 program compares the data from the plurality of power supplies with data of at least one predetermined event to determine if a predetermined event has occurred. The database stores information relating to an occurrence of the predetermined event and the number of the power supplies associated with the occurrence of the predetermined event. The electronic notification program sends an electronic notification, which includes
15 information about the occurrence of the predetermined event and the number of the power supplies to which the event occurred, to one or more predetermined destinations.

In another embodiment of the invention, a method of providing notification of a predetermined event of a power supply includes obtaining data from the power supply, comparing the obtained data from the power supply with at least one predetermined event
20 to determine if a predetermined event has occurred, storing information relating to the occurrence of the predetermined event and the number of the power supplies associated with the occurrence of the predetermined event, and sending over the computer network an electronic mail including information relating to the occurrence of the predetermined

event and the number of the power supplies associated with the occurrence of the predetermined event.

An advantage of embodiments of the invention include automatically determining if one or more specified events occurred to one or more of the plurality power supplies rather than completing the task manually. Additionally, in embodiments of the invention, one or more users can automatically be provided an electronic notification, such as an e-mail, of the occurrence of the one or more specified events.

Brief Description of the Drawings

FIG. 1 is an exemplary block diagram of the power supply event notification system according to the present invention; and

FIG. 2 is a flowchart of an exemplary method of monitoring a power supply according to the present invention.

Detailed Description of the Invention

Referring to FIG. 1, the power supply event notification system 10 can include a plurality of uninterruptible power supplies (UPS) 12a-12d that are each connected to a computer network 14. Each UPS 12 can be connected to the network through the use of a network card 16 in the UPS or the UPS can be serially connected to a computer 18 that has a network card. The network can be a local area network (LAN), a wide area network (WAN) or the Internet. Also connected to the network is a server computer 20. Server computer 20 has a database 22 and one or more software programs running thereon. For example, the server can have a data retrieval program 24, a comparison program 26, an electronic notification program 28 and a device identification program 27

as described below. The electronic notification program 28 can send an electronic notification, such as an e-mail, if a predetermined event should occur to a UPS. The server can use the simple network management protocol (SNMP) to communicate with the one or more UPS's.

5 The network 14 can also be connected to a monitoring station 29, which can be located at a vendor's facility. One example of a monitoring station is American Power Conversion's Network Operations Center. An electronic notification, such as an e-mail, can be sent to the monitoring station if a predetermined event should occur to one or more of the UPS's. The benefit of having a monitoring station connected to the network
10 is that it allows the station not only to keep up-to-date information about the UPS's, but to offer timely maintenance or replacements for them as necessary.

 Referring to FIG. 2, an exemplary method 30 for providing notification of a predetermined event to a power supply begins at 32 with obtaining information of one or more predetermined events. The predetermined events can include, for example, a
15 specified age of a UPS, a power supply or a battery, a predetermined remaining runtime of a battery, a failure of a UPS, a power supply or a battery to pass a self diagnostic test, a UPS or power supply being unavailable or a change of the power load of the power supply system being greater than a predetermined limit. At 34, the server 20 obtains one or more threshold values if necessary, such as the age or the remaining runtime of a
20 battery. The obtained threshold values are preferably set as default values in the server software and are changable such that the default threshold values are user definable. A threshold level may not be necessary for some events, such as for the failure of a battery.

At 36, a data retrieval program obtains data over the network from the UPS's. At 38, a comparison program compares UPS data with a predetermined event to determine if one of the conditions has occurred. If no predetermined condition has occurred, the comparison program goes to step 46. If a predetermined condition has occurred at 40, then the comparison program determines at 42 whether the condition was within the one or more predetermined threshold values if any were specified. If the condition wasn't within the predetermined threshold values, the comparison program goes to 46. If the condition was within the predetermined threshold values, then at 44 the electronic notification system will send an electronic notification such as an e-mail or an instant messaging notification to one or more predetermined destinations. The comparison program can execute a loop in its program to ensure that it has compared all specified events at 46 and all data at 48 and if it has not done so then go back to 40 or 38, respectively. Once all the data has been compared to all the events, the system can wait a predetermined time period before obtaining data from the UPS's again and at 36 repeating the method described herein. Alternatively, the method described herein may only be used when a fault or event is suspected and thus, it may not be necessary that the program repeat itself at 50.

Preferably, the electronic notification program reports all data that it has gathered such that a user can make the most informed decisions based on the reported data.

Alternatively, the electronic notification program can be selective in the reported data. For example, the specified events can have a hierarchy in which once a highest event has been found to occur, it will not be necessary to check and report the occurrence of the other events for that power supply or even the whole network if desired. This may be .

preferable to prevent the sending of two messages for the same event, such as “a UPS battery has expired” and “a UPS does not have backup power,” when the reason that the UPS does not have backup power is that its battery has expired.

Preferably, the electronic notification program doesn’t send out a notification until all data has been compared with all the events. For example, the electronic notification can report the data as “17 UPS’s are too old” and/or “5 UPS’s have a remaining runtime less than 30 minutes.” After the notification program 28 has provided data about the number of devices to which one or more predetermined events has occurred, a device identification program 27 can be run to specify exactly the devices to which the reported predetermined event has occurred. It should be noted that the information about the number of devices provided by the notification program 28 can include the exact number of devices or merely be a list of the devices to which the event occurred that can be added to provide the number of devices.

It should be understood that although the description above has described embodiments of the invention as having a separate data retrieval program, a comparison program and an electronic notification program, the three programs can easily be combined within one or two programs or could be separated into more than three programs and still be within the scope of the invention. Also, the methods of the programs can be completed either through software or hardware. Any software used with the present invention can be stored on any type of a computer usable medium for storing data, such as, for example, but not limited to, floppy disks, magnetic tape, zip disks, hard drives, CD-ROM, optical disks, or a combination of these.

It should be also understood that although the description above has described embodiments of the invention as used with a UPS, the invention is also applicable to systems using one or more power supplies connected to a computer network.

The present invention allows users to provide better reliability for UPS's and/or power supplies because the users can obtain various types of information about the UPS's and/or power supplies and maintain or replace them as required. Additionally, if the obtained data is sent to a vendor, such as through an e-mail, the vendor can use the information to improve or upgrade a product if data indicates that the product has deficiencies.

Having thus described at least one illustrative embodiment of the invention, various alterations, modifications and improvements will readily occur to those skilled in the art. Such alterations, modifications and improvements are intended to be within the scope and spirit of the invention. Accordingly, the foregoing description is by way of example only and is not intended as limiting. The invention's limit is defined only in the following claims and the equivalents thereto.

What is claimed is: